

The US Economic and Social Costs of Alzheimer's Disease Revisited

ABSTRACT

Objectives. An earlier paper estimated the per-case and national incidence costs of Alzheimer's disease for 1983. This paper updates the estimates of costs per case to 1991 and presents new national prevalence estimates of the economic and social costs of the disease.

Methods. All data for the cost estimates were taken from published sources or provided by other researchers.

Results. At midrange values of the estimated cost and epidemiological parameters, the discounted (at 4%) direct and total costs of Alzheimer's disease were \$47 581 and \$173 932 per case, respectively. The estimated 1991 national direct and total prevalence costs were \$20.6 billion and \$67.3 billion, respectively. Assuming conservatively that the prevalence of the disease remains constant, the estimated discounted present values of the direct and total costs of all current and future generations of Alzheimer's patients are \$536 billion and \$1.75 trillion, respectively.

Conclusions. The \$536 billion and \$1.75 trillion figures are minimum estimates of the long-term dollar losses to the US economy in 1991 caused by Alzheimer's disease. (*Am J Public Health.* 1994;84:1261-1264)

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Introduction

This paper presents per-case and prevalence estimates of the costs of Alzheimer's disease for the year 1991. The data for the estimates were taken from published sources or provided to us by other researchers. In a previous paper, we estimated the costs of this disease for the year 1983.¹ In this revision we have drawn on a newer and more extensive body of findings.

Methods

The methodology used here is discussed in our earlier paper.¹ Briefly, it is assumed that (1) the cost of Alzheimer's disease is an opportunity cost measured apart from the normal costs of living and health care; (2) the stream of costs begins and the patient becomes completely disabled at the time of diagnosis; (3) the patient's annual costs are constant from diagnosis to death; and (4) the stream of the patient's annual costs is discounted to 1991 at a rate of 4%. Finally, because multiple reports of many epidemiological and cost parameters for Alzheimer's disease exist, interval estimates of the disease population and costs were constructed. The point estimates given below are based on midrange estimates of the individual parameters. The details of the estimation procedures are not presented in full but are available from the authors.

Results

The Epidemiology of Alzheimer's Disease

We estimated the prevalence rates of Alzheimer's disease by age and sex for persons 65 and older from data in three US studies.²⁻⁴ Applied to the middle

series US population forecast for 1991,⁵ our estimates give a prevalence rate for Alzheimer's disease of 0.042 and a total of 1.35 million cases in the population 65 and older. Other reported rates are much higher,^{6,7} possibly owing to diagnostic inaccuracies or the inclusion of mild cases.^{8,9} The absence of data on the occurrence of this disease in persons under age 65 forced us to estimate the prevalence in this age group. We assumed that the prevalence rate for persons under age 45 is zero and that the fraction of Alzheimer's patients diagnosed before age 65 is the same as that with symptom onset before age 60 (diagnosis lags symptom onset by 3.5 to 5.5 years¹⁰⁻¹⁵). Based on the age distributions of Alzheimer's patients given in two US reports,^{16,17} we estimated the number of patients aged 45 to 64 at 245 000 persons.

We found only one useful US study giving incidence rates of Alzheimer's disease by age and sex,¹⁸ so we added data from Swedish and Israeli studies^{19,20} to those results. Our estimated incidence rates yielded 266 000 newly diagnosed US cases of the disease in 1991.

The duration of survival with Alzheimer's disease from symptom onset falls with the patient's age,^{16,21} but the effect of age on survival after diagnosis has not been studied. Hence, we assumed that survival after diagnosis is independent of

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Note. The views expressed here are solely those of the authors.

TABLE 1—Estimated Net Costs of Alzheimer's Disease per Person in 1991 (Midrange Estimates)

| | |
|---|----------|
| Annual (undiscounted) direct costs | |
| Diagnosis (first year only) | \$ 1 450 |
| Nursing home | 7 570 |
| Long-term mental hospital | 392 |
| Paid home care | 3 140 |
| Regular physician care | 233 |
| Acute care hospitalization | 1 202 |
| Other patient direct costs | 0 |
| Caregiver medical care | 153 |
| Total direct cost (first year only) | 14 140 |
| Total direct cost (second and later years) | 12 690 |
| Annual (undiscounted) indirect costs of unpaid home care | |
| | 20 900 |
| Total cost first year, excluding morbidity and mortality | 35 040 |
| Total cost second and later years, excluding morbidity and mortality | 33 590 |
| Total discounted direct cost ^a | 47 581 |
| Total discounted (direct cost + unpaid caregiver cost) ^a | 123 556 |
| Total discounted (direct cost + unpaid caregiver cost + disability and premature mortality cost) ^a | 173 932 |

^aAssuming a 4% annual discount rate and survival of 3.3 years for men, 4.3 years for women.

age. We assumed further that women live 4.3 years after diagnosis and men live 3.3 years—the averages of disease durations reported in two studies of Alzheimer's.^{14,22}

The Costs of Alzheimer's Disease

Alzheimer's patients are cared for in the community, in nursing homes, and in mental hospitals, but the number of patients treated at each of these locations is unknown. We therefore estimated the number of patients living at each location before estimating the costs of care.

Nursing home costs. Extrapolating from data in the National Nursing Home Survey of 1985,²³ we estimated the average daily nursing home census at 1.743 million persons in 1991. Unfortunately, data on the percentage of residents with Alzheimer's disease vary widely. Estimates from the Nursing Home Survey vary from 6.3% to 9.4%,^{23,24} but a national survey of Medicaid nursing home residents found that 23.5% were diagnosed with the disease.²⁵ The Nursing Home Survey data themselves indicated that 43.3% of all residents in 1985 were diagnosed with organic brain syndrome, and, assuming that 60% to 70% of organic brain syndrome is due to Alzheimer's disease,^{26–29} this estimate implies a range of 26.0% to 30.3% of all residents with Alzheimer's. Accordingly, we determined the percentage of Alzheimer's patients in nursing homes in 1991 to be 10% to 30%, the midrange of which gave an estimate of 349 000 residents with the disease.

Based on our estimate of nursing home average daily census, national nursing home spending in 1991³⁰ amounted to \$34 400 per annual resident. Since it is claimed that the cost for a demented patient is 12% to 20% higher than the average,^{31,32} we put the gross annual nursing home cost for an Alzheimer's patient at \$38 500 to \$41 300. We estimated normal annual usage of nursing homes by persons aged 45 and older (the ratio of residents without Alzheimer's disease to the population at risk) at 0.016 to 0.020 years, and calculated the normal annual cost of food and shelter to be \$4700 per person in 1991.³³ Hence, the estimated annual net cost of Alzheimer's nursing home care was \$7570 per patient overall.

Mental hospital costs. We estimated the number of mental hospital patients in 1991 (185 000 persons) by projecting an annual time series of average daily censuses.³⁴ The number of Alzheimer's patients living in mental hospitals was estimated from data in two studies on residents with organic brain syndrome or probable Alzheimer's disease,^{34,35} and was reckoned at 4000 to 7000 in 1991. The estimated gross annual cost of mental hospitalization was \$113 600 per patient with Alzheimer's—obtained by inflating the overall average cost per patient in 1988³⁴ to 1991 levels by the medical care component of the consumer price index. Normal mental hospital usage was deter-

mined to be negligible so that, apart from normal living costs, the estimate of annual mental hospital costs was \$392 per person with Alzheimer's disease.

The cost of community care. Community care refers both to nonmedical services provided to patients with Alzheimer's disease and to respite services for caregivers. The number of Alzheimer's patients living in the community (the Alzheimer's population less the number of institutionalized patients) was estimated at 1.240 million persons. Based on results from nine studies of community-dwelling demented or mentally impaired patients, we estimated the weekly number of paid and unpaid caregiver hours at 7.9 and 52.5, respectively.^{31,36–44} Paid caregiver time was priced at \$9.38 (the rate for home health care workers in 1991⁴⁵), but that figure is at least 10% lower than the hourly cost (expressed in 1991 dollars) reported in three studies of caregiving for demented persons,^{31,44,46} and it also excludes home care agency costs. We therefore set the hourly rate at \$9.40 to \$10.30 and assumed that the opportunity cost of unpaid caregiver time was the same. The resulting estimates of gross annual paid and unpaid caregiver time were \$4050 and \$26 900 for the home-dwelling patient. Because the normal amount of in-home caregiver time is negligible,^{46–50} the annual net costs of paid and unpaid community care were \$3150 and \$20 900 per Alzheimer's patient overall.

Physicians' services: diagnosis. Diagnostic costs were estimated at \$1450 per patient in 1991. The figure is our 1983 estimate (based on 1987 technology) of the cost inflated by the medical services component of the consumer price index.

Physicians' services: regular care. In five studies it has been reported that (mostly) elderly patients with Alzheimer's disease or dementia use 0.8 to 2.4 times as many physician visits as the average for all persons 65 and older (6 to 19.5 visits per year^{36,42–44,48} vs 8.2 visits⁵¹). If the same multiple holds regardless of age, then patients with Alzheimer's disease average from 1.3 fewer to 9.2 more visits annually than all persons aged 45 and older (6.6 in 1990⁵¹). To cost these visits, we drew on 1990 physician survey data from the American Medical Association^{52,53} inflated to 1991 price levels, and we estimated physicians' average revenue per visit at \$59 in 1991. The (midrange) estimated annual net cost of outpatient physician services was therefore \$233 per Alzheimer's patient in 1991.

Hospitalization. In various studies, persons with Alzheimer's disease or other mental impairment used the hospital 30% to 200% more than normal controls or the national average,^{36,42,43,54} roughly the same as the normal population,^{31,55} or less than normal persons.⁵⁶ Given these contradictory findings, we assumed that the average Alzheimer's patient used 0 to 200% more hospital days annually than a normal person aged 45 or older (1.37 days in 1990⁵¹). This would have meant an additional 0 to 2.7 inpatient days priced (apart from normal daily living costs) at \$831 each,⁵⁷ plus one physician visit per day costing \$59. The total net cost of hospital use was \$1202 per patient in 1991.

Other direct costs. Other costs of Alzheimer's disease mentioned in the literature are associated with prescribed drugs, transportation, and health care visits to (or by) nonphysician providers,^{31,36,42,43,58} but owing to scanty or contradictory evidence, we assumed that these costs were zero.

Caregiver costs. Caregiving for Alzheimer's disease causes economic costs only when it leads to an abnormal use or loss of economic resources. The costs of respite services and caregivers' loss of productive time have been counted in the costs of home care, but another cost occurs if the caregiver uses an abnormal amount of medical care. According to reports, caregivers of demented persons use 46% more physician visits and 71% more prescribed drugs than control subjects, and are more likely to be hospitalized as well^{59,60}; however, it has also been found that physician usage and sick days are essentially the same for Alzheimer's caregivers and matched control subjects.³⁸ Hence, we estimated additional physician costs at 0 to \$224, drug costs at 0 to \$170 per caregiver-year (the upper bound is 0.71 times national per capita drug purchases in 1991⁴³), and hospital costs at zero. Estimated net caregiver costs were \$153 per Alzheimer's patient overall.

Loss of lifetime earnings owing to disability and premature mortality. The loss of the Alzheimer's patient's labor income dates from diagnosis and covers the period of a normal life expectancy.⁶¹ We estimated lifetime earnings from an age-income profile provided to us by Dorothy Rice and her associates. The income streams were discounted at 4% and aggregated over all persons diagnosed with the disease in 1991. The earnings loss was estimated at about \$50 380 per person.

Total costs. The midrange estimates of annual costs per Alzheimer's patient

and costs per case are summarized in Table 1. The annual prevalence cost of the disease is the size of the Alzheimer's population times the average annual cost per patient. At midrange values of the parameters, estimated direct prevalence costs were \$20.6 billion in 1991. Total annual unpaid caregiver costs were \$33.3 billion, and the present value of the costs of disability and premature mortality were \$13.4 billion for persons first diagnosed in 1991. Altogether, the 1991 annual prevalence costs of Alzheimer's disease were \$67.3 billion. Supposing conservatively that the Alzheimer's population is constant over time, the present values of the annual direct and total costs of all future generations of Alzheimer's patients beginning in 1991 are about \$536 billion and \$1.75 trillion, respectively. These figures are the estimated discounted direct and total present values of resources that society will consume or lose because of this disease beginning in 1991.

Conclusion

The costs of caring for a patient with Alzheimer's disease, as reported here, are higher than those (for 1983) given in our earlier paper owing partly to price inflation and partly to new assumptions drawn from the literature. Adjusted to 1990/91 price levels, other (data-based) estimates of the annual direct and unpaid caregiver costs of Alzheimer's disease or mental impairment range from about \$12 000 to \$47 000 per patient.^{31,32,36,41} Our figures (\$33 600 to \$35 000) fall toward the middle of this range, but comparisons between them and the other estimates are tenuous because of differences in methodology. Nevertheless, all the estimates indicate that the major economic burden of Alzheimer's is the cost of long-term home and institutional care. For home-dwelling patients, most of this burden—nearly \$31 000 per person in 1991—is borne indirectly by caregivers, but much of the cost of institutionalization falls on the public at large. Assuming that 20% of all nursing home residents had Alzheimers, Medicaid spent \$5.7 billion³⁰ in 1991 on these patients. To add some perspective on this cost, we estimate that the total medical cost of acquired immunodeficiency syndrome (AIDS) was no more than \$4.2 billion in 1991 (assuming 77 000 cases⁶² and a cost per case of \$50 000 to \$55 000⁶³). Thus, even the Medicaid cost of Alzheimer's probably exceeds the total medical cost of a more publicized disease like AIDS. Clearly, the discovery of

palliatives or cures for Alzheimer's disease would greatly benefit society as a whole. □

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